Evolving Strategies in Blackjack

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***Abstract*-Blackjack is a casino game that affords the player an opportunity to have an advantage over the house. The player can play a "basic strategy" that offers an approximately break-even wager. When also taking the distribution of cards played in prior hands into account, the odds can favor the player. Well-known playing strategies have been developed by examining different situations in the game and computing the optimum play for each setting. However, the decisions made at one setting affect the probabilities of being in other settings during the course of play. Simulation provides the basis for optimizing blackjack strategies as a whole, as opposed to in a piecemeal fashion. This paper reports on experiments conducted to evolve basic and counting strategies for blackjack.**

I. Introduction

Recent interest in evolutionary computation for games has included work on evolving strategies in blackjack [1]. The current paper presents previously unpublished work [2] that focused on evolving basic and counting strategies in blackjack. The results of these evolutionary experiments were provided in an invited lecture to the ORSA/TIMS (Operations Research Society of America and The Institute for Management Sciences) meeting in Phoenix, Arizona in 1993 but remained unpublished. Some of the results are provided here in the hope that they may provide guidance for future experimentation.

II. Background on Blackjack

A. Rules

Blackjack, also known as 21, is a card game in which a player or players compete against the dealer or "house." The rules vary by casino, and even by country. The rules offered here are mainly for American casinos, which tend to offer players more options than may be found elsewhere.

The dealer and each player receives two cards. The dealer turns the first of his cards face up and the other remains face down. Players' cards are typically dealt face up, but this is not necessary.

The object of the game is to come as close to 21 as possible without going over, which is termed "busting." Each card is counted as its face value, with face cards counting 10, and aces being counted as 1 or 11, at the player's discretion. The dealer must follow fixed rules, which prescribe generally that the dealer must continue to take cards until reaching a total of 17 or higher. Dealer aces are counted generally as 11 unless it would cause the dealer to bust. The player, unlike the dealer, has the discretion to hit or stand, and in certain cases has additional options of "splitting" or "doubling down."

If the first two cards dealt to the player yield 21, this is called "blackjack" and pays at the rate of 3:2 to the amount wagered; however, if the dealer also has 21 in two cards, the hand is considered a draw or a "push."

If the dealer's up card is an ace, the player may purchase "insurance" for half the amount of the player's wager. Insurance pays 2:1 if the dealer has blackjack, otherwise the player loses his insurance wager.

If the player has two cards of equal denomination on the deal, he may split the cards into two new hands. The player must offer an additional wager equal to the previous wager to cover both hands. Each hand is dealt an additional card and played separately. The resulting hands can also be split, except generally in the case of aces, which may not be resplit, and in many cases are allowed to receive only one additional card.

Also, on the initial deal, when the player has two cards, he has the option of "doubling down," in which he doubles his wager and takes one and only one additional card.

If the player goes over 21, either by doubling down or hitting, he busts and immediately loses his wager. If the player stands at a value less than or equal to 21, the play proceeds to the dealer, who then turns over his down card. If the dealer does not have a two-card hand of 17 or higher ("pat hand"), he receives cards until either busting or reaching a pat hand. If the dealer busts, the player wins his wager. If the dealer reaches a pat hand, then if the player has a higher value than the dealer, the player wins his wager. If the dealer has a higher value, the player loses his wager. If the dealer and the player achieve the same value, the wager is a push and the player retains the bet.

Different casinos offer slight variations of the rules [9]. They may use a single deck and/or multiple decks. They may reshuffle whenever desired, or when processing a fixed percentage of cards. They may limit the player to doubling down on 10 or 11 as opposed to any two cards. They may prohibit doubling down on any so-called "soft hand," which involves an ace that may be counted as 1 or 11. They may limit the number of times a player may split cards, or whether or not the player may split 10s. They may fail to offer the insurance wager. These and other variations affect the potential profitability of player strategies.

B. History

Of all the casino games, only blackjack presents the player with an opportunity to have an advantage over the house. No amount of skill or smarts can overcome the house edge in craps, roulette, slots, keno, or other games of chance. The intelligent player, however, can win consistently at blackjack by "counting cards," using the history of which cards have been played to guide how to play future hands.

This first became evident when Dr. Edward Thorp, a professor of mathematics, wrote *Beat the Dealer* in 1962 [3]. This book provided provably profitable strategies. Thorp received national publicity and casinos panicked. They even changed the rules of the game. Their fear was premature. Instead of losing money to hundreds of card counters armed with Thorp's strategies, their profits dropped because many fewer people wanted to play the "new" blackjack. Much like Coca-cola returning to its "classic" beverage after changing to a "new Coke," the casinos restored blackjack to the way it was, with just a few important modifications, such as the addition of multiple decks.

Casinos learned Thorp's methods and discovered techniques to counter his strategies. Ultimately, when they faced a player who was smart enough to overcome these countermeasures, they simply banned him from the casino. The serious player had to not only memorize and perfect a fairly complicated strategy, but also had to disguise the fact that he was using it.

Thorp had discovered a profitable strategy for blackjack by improving on the work of Dr. Roger Baldwin. In 1956, Baldwin, together with three other colleagues published "The Optimum Strategy in Blackjack" [4]. Thorp's approach was to examine particular situations in the game through empirical trials.

For example, if you hold a 16 (say, a king and a six), and the dealer shows a 10, should you hit or stand? One way to answer this is to conduct two sets of experiments where in the first set, the player always hits the 16, and in the second set, the player always stands. After playing a large number of hands, the superior play is determined to be the one that earns the player the most money. This method demonstrated conclusively that it is better to hit a 16 when the dealer shows a 10, rather than to stand.

High-speed computers (recall, this refers to high-speed computers in the 1960s) were used to simulate each distinct situation in the game. The computer calculated the correct move for each element, and each of these correct moves was pieced back together to form an overall strategy. The strategies were defined based on either (1) starting from a fresh deck or decks of cards – a so-called "basic strategy" – or (2) reflecting the distribution of types of cards, such as low or high, or 10s, or 5s, that had already been played in prior hands – so-called "counting strategies."

These strategies have survived in general form to the current day. Each strategy comprises essentially the "sum of the parts" decisions for each separate situation that can be considered.

No one has yet shown conclusively that there are significant advantages to moving beyond this piecemeal analysis, but this may be possible. As offered in [2], blackjack is a nonlinear potentially chaotic game.

In one case, Thorp [3] analyzed the player advantage when the (single) deck contained all 16 tens, and when a number of the tens were removed. He found that using his basic strategy, the player had a +0.13% advantage[1] with all 16 tens, but had a disadvantage of −1.85% when there were 12 tens, a −3.13% disadvantage when there were 8 tens, a −2.14% disadvantage when there were 4 tens, and a +1.62% advantage when no ten remained. There was no linear relationship between the number of tens and the player's advantage or disadvantage.

More generally, small fluctuations in the order of the cards can generate widely varied results. This is

[1] A +0.13% advantage means that for every $100 the player bets he would win 13 cents on average.

part because the player's decisions interact with each other in each situation. For example, should the player decide to hit a 12 when the dealer shows a 6, the player will increase the number of 13s, 14s, 15s, and other higher-valued hands that he holds subsequently because some of the time he will receive low-valued cards. If the player stands the 12, he will receive fewer 13s, 14s, 15s, and so forth. One shouldn't expect to determine the correct action to take when the player holds a 12 and the dealer shows a 6, without examining its effect on all other possible situations. Given the complexity of the required analysis, the apparent best way to address this is to search for optimal strategies through simulation of sequences of hands of play under casino conditions. As indicated in a subsequent section, evolutionary algorithms can be used for this purpose.

C. Basic strategy

There are many published variations of basic strategy. In basic strategy, the player makes the same play in the same setting without respect to which cards have been played in prior hands.

Some of these published variations reflect whether a single or multiple decks are used, as well as various rule changes. Others likely reflect a desire of a particular author to have "his own strategy" for a book or other public consumption. The main basic strategies that can be found in bookstores are owed originally to Thorp [3], as well as Lawrence Revere (a penname, in collaboration with Julian Braun of IBM) [5], John Archer [6], John Gollehon [7], Jerry Patterson and Eddie Olsen [8], and a few others (e.g., Ken Uston, who used team play). A complete listing is beyond the scope of this paper.

In 1987, through simulation, I was able to estimate the player advantage or disadvantage for each of these strategies. As a baseline, if the player merely mimicked the dealer's rules and hits up to 16 and stands on 17 or higher, in 100,000 simulated hands, the player faced a disadvantage between –5.56% and –6.78% with 95% confidence.

Thorp offered that the single-deck player advantage with his basic strategy was +0.13%. A simulation of over 3 million hands with this strategy yielded –0.024% (–0.14% to +0.091% with 95% confidence). The fact that Thorp's estimate falls outside the 95% confidence interval should not be used to question his result. It could be that the rules in his calculations were more favorable to the player. Generally, Thorp's basic strategy may be described as a break even method. In testing 3 million hands with his strategy against a four-deck game, the disadvantage was –0.41% (–0.51% to –0.328% with 95% confidence). Thorp's basic strategy is offered in Appendix 1.

For comparison, the results with other strategies over 3 million simulated hands were:

Revere 1-Deck: –0.019% (–0.135%; +0.096%)
Revere 4-Decks: –0.436% (–0.551%; –0.321%)
Archer 1-Deck: –0.026% (–0.141%; +0.090%)
Archer 4-Decks: –0.433% (–0.548%; –0.318%)
Gollehon 1-Deck: +0.058% (–0.057%; +0.173%)
Gollehon 4-Decks: –0.431% (–0.546%; –0.316%)
Patterson 1-Deck: –0.019% (–0.135%; +0.096%)
Patterson 4-Decks: –0.705% (–0.82%; –0.59%)

The numbers in parentheses indicate the 95% confidence intervals. Although the percentages vary, generally the basic strategies are break even strategies against a single deck and place the player at a slight disadvantage when facing a game with four decks.

D. Counting strategies

There are more variations of counting strategies than there are variations of basic strategy. Computer simulation has shown that the player can have an advantage over the house by altering his strategy based on the distribution of cards played in prior hands.

In [3], Thorp examined the player advantage when a full deck is changed by removing all of the cards of a given rank (i.e., when the deck contains no 2s, 3s, and so forth). The result was:

Type of Missing Card	Player Advantage %
Aces	–2.42
Twos	+1.75
Threes	+2.14
Fours	+2.64
Fives	+3.58
Sixes	+2.40
Sevens	+2.05
Eights	+0.43
Nines	–0.41
Tens	+1.62

From the earlier section of this paper, recall that as 10s are removed, the player faces a disadvantage, although if all tens are removed, the player has an advantage. The casino, however, will rarely allow the deal to go down sufficiently far into the deck(s) such that all 10s would be removed. Therefore, the absence of 10s is generally a liability.

The most significant single card is the 5, where the player's advantage increases as the number of 5s in the deck decreases. The 5 is important because it takes any hand between 12-16 and turns it into a hand between 17-21. For the dealer, when there are more 5s in the deck, there is a better chance of "making a hand" instead of busting.

Despite the simple strategy of betting more when 5s are removed from the deck, most counting strategies are much more complicated. The two most common counting variations rely on keeping track of the ratio of 10s to non-10s, or the plus-minus running count of low-high cards. Here, I focus on the latter plus-minus counting strategies.

Generally, the low cards are the 2, 3, 4, 5, and 6, whereas the high cards are 10s and aces. The 7, 8, and 9 are considered neutral. As cards are removed from the deck, low cards increase the count by +1. High cards decrease the count by −1. The running count gives the player an indication of their advantage, where the absence of low cards gives the player the edge.

The count is computed on the fly as cards are dealt. If you are the sole player at a table and you receive a 6 and a 7, with the dealer showing a 10, the count is even. If you hit the 13 and get a 10, busting, that makes the count −1. The dealer then shows his card, say, a 4, which brings the count back to even. With practice, a player can compute the running count reliably and quickly in *optimum conditions*. This is necessary to have a consistent advantage because every miscalculation gives back an edge to house. The casino presents less than optimum conditions.

The "true count" is found by dividing the running count by the number of remaining decks. This is one of the reasons that the casinos added decks to their games after Thorp's pioneering efforts. Computing the true count requires more concentration, and the variation of the running true count is reduced as the number of decks increases. This limits the exposure of the casino to situations in which the player has a significant advantage.

Thorp suggested that a player increase his wager in proportion to the true count. When the count is +1 or lower, the player should bet one unit. If the count is +5, then the player should bet five units. Although this is logical because the true count reflects the player's chances of winning, it tends to attract attention from casino employees (pit bosses) who may ask the player to leave.[2]

Plus-minus counting strategies not only direct the player to wager more when the count is in their favor, but also alter the plays that the player makes based on the true count.

For example, Patterson and Olsen suggest changes to the playing strategy by standing on the following hands if the true count is greater than the number in parentheses:

12 vs. 2 (+3), 12 vs. 3 (+2), 12 vs. 4 (0), 12 vs. 5 (–2), 12 vs. 6 (–1), 13 vs. 2 (–1), 13 vs. 3 (–2), 13 vs. 4 (–4), 13 vs. 5-6 (–5), 14 vs. 2 (–4), 14 vs 3 (–5), 14 vs. 4 (–7), 15 vs. 2 (–6), 15 vs. 3 (–7), 15 vs. 10 (+4), 16 vs. 9 (+5), 16 vs. 10 (0), 17 vs. A (–7)[3]

In addition, you should take insurance if the true count is greater than or equal to +3 in a multiple-deck game or +2 in a single-deck game.

I tested this plus-minus strategy on 1 million simulated hands using a single-deck game and it returned an advantage of +0.559% (+0.32%; +0.799%). On a four-deck game, however, it yielded a loss of –0.206% (–0.446%; +0.033%).

III. Evolving Blackjack Strategies

Starting with Gollehon's basic strategy and three random variants of the strategy, a (4+4) evolutionary algorithm (EA) was used to optimize the strategies in light of three million simulated hands on a single deck, reshuffling after 2/3 of the deck had been played using standard Las Vegas strip rules (similar to those described in Section I.A). Strategies were represented as entries in matrices describing decisions for hit/stand, double

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[2] For example, in Nevada; casinos do not have the right to ask players to leave without cause in all states. For example, in Atlantic City, New Jersey, by law, card counters are not banned (at least from personal recollection in the 1980s), so the casinos use many decks to reduce the true count.

[3] I believe this is a misprint in *Break the Dealer* because no rational player would hit a hard 17 even if it were the statistically correct decision to make because the attention it would bring would not be worth any expected gain. Nevertheless, this is what is printed.

down, and split, following the example of Appendix 1. Simple mutation was used to create an offspring from each parent, altering multiple entries in the strategy. In addition, the option to stop play was allowed based on a hand played.[4] After 10 generations, the best evolved strategy offered an advantage of +0.218% (+0.102%; +0.334%). Based on the 95% confidence interval, it was a winning strategy. This strategy is offered in Appendix 2. Each generation of evolution required just less than three days on the Macintosh SE.

This evolution was extended for 10 more generations on a four-deck game. The best evolved strategy yielded a result of –0.245% (–0.360%; –0.130%).

For evolving counting strategies, the best-evolved basic strategy and two random variants of this strategy were further evolved using a (3+3)-EA in single-deck play. Mutation affected the threshold for a decision in each of the situations as shown in Appendix 2. The number of hands used in simulation to evaluate a strategy was set initially to 400,000 and increased over time to speed the process. Fifty generations were executed using the plus-minus counting framework (2-6 count +1, 7-9 count 0, 10s and aces count –1). The final best-evolved strategy is shown in Appendix 3. On 3 million simulated hands, it evidenced an advantage of +1.821% (+1.653%; +1.988%). The same strategy earned a profit of +0.927% (+0.77%; +1.084%) over 3 million hands with a two-deck game, +0.305% (+0.159%; +0.451%) with a four-deck game, and –0.115% (–0.252%; +0.022%) with an eight-deck game.

The counting strategy breaks down against multiple decks because the true count hovers closer to even for most of game play, and the counting strategy in essence becomes the basic strategy.

IV. Discussion

The results presented in the prior section were derived in 1987 and 1988. In 1988, I went to Atlantic City, New Jersey and Las Vegas, Nevada for three days in each city and played blackjack using the evolved plus-minus counting strategy. In Atlantic City, over three days playing about 250 hands per day (4 hours of about 60 hands per hour) with a basic unit bet of $5, I won about $55. In Las Vegas, playing about the same amount, I won about $150. This is merely anecdotal accounting but the experience offers some insight into effecting positive outcomes in the real-world of the casino, beyond simulation.

In Atlantic City, at casinos such as Bally's Grand, the rules required that you play every hand in a six- or eight-deck "shoe." If you sat out any hand (presumably because the true count had gone negative) you would have to wait until the cards were reshuffled. Many tables were full or nearly full for the entire playing time, so sitting out hands was not a viable option because another player would want to take your spot. My rule was to leave the table if the true count fell below –2.

In the case where tables were not full, however, I had the opportunity to wait until the true count was at least +1 before sitting down to the first hand. In Las Vegas, I suspect such activity would have been monitored closely by the pit bosses.

I was uncomfortable betting an amount equal to the true count in Las Vegas. (In all the time spent in Atlantic City, the true count only exceeded +2 briefly.) I was concerned about being asked to leave. I therefore bet four units ($20) on the first hand when sitting down or at the start of each shuffled deck and bet with the true count after that, thinking that this would disguise my play somewhat. In retrospect, I doubt the pit bosses cared much about a young kid playing for low stakes.

V. Conclusions

The standard blackjack strategies rely on a separate analysis of the correct play in each of a set of various possible situations. Each of these situations is viewed independently. When the correct plays are combined, the player can at least play at almost even odds with the house, depending on the rules in force. Furthermore, by altering betting and the decisions taken based on the composition of cards that have been played, the player can have a decided advantage over the house.

The decisions made during the course of play can affect the probabilities of being in different states in future plays, so it is reasonable to view the

[4] I believe this was an entirely novel idea to incorporate into blackjack strategy, in essence, doing a "player shuffle." In the end, I personally extended this to include stopping when two or more aces were played in a single round, owing to the importance of aces as seen in Section II.D.

challenge of finding optimum strategies as a nonlinear problem that should be addressed by lifelike simulation of sequences of hands played until a deck or decks is/are reshuffled. Results from unpublished experiments performed many years ago indicate that strategies can be evolved using simple variation and selection procedures that outperform some published strategies found in popular books.

Given that computing speeds have increased about 1000-fold since the experiments reported here, it would be interesting to reexamine the problem of evolving strategies, including the novel aspects of how much to bet on opening hands, and when to stop play until a new shuffle. I hope that the results offered here may provide some baseline for comparison and inspiration for future research.

Remarks and Acknowledgments

I thank the reviewers for their comments and criticisms on the paper.

The results presented here date back to research I performed about 17 years ago, when I was a graduate student at the University of Hawaii at Manoa in 1987, and then later in 1988 in collaboration with a colleague Robert Redfield, leading to an unpublished book [2]. In preparation for [2], I simulated over 400 million hands of blackjack using mainly personal desktop Macintosh SE computers. The simulations computed the outcome of about 3000 hands per minute. Many of the details of the effort have been lost over time and the methods reported here may not be replicable.

I learned my first counting strategy when I was 14 years old by studying Lawrence Revere's *Playing Blackjack as a Business*. I was, of course, unable to test my prowess in the casino at that young age. In high school, my friend Scott Ugoretz challenged me to, at some point in my life, take on the life of a professional gambler for a week. The research presented here gave me the opportunity to live up to this challenge.

Scott passed away in 1988 at the age of 24. I had dedicated [2] to him in memory, but since [2] was never published, perhaps it's appropriate for me to rededicate this work to him now. And I thank my brother Gary for this suggestion.

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APPENDIX 1 : THORP'S BASIC STRATEGY

	DEALER'S UPCARD									
YOUR HAND	2	3	4	5	6	7	8	9	10	A
12	H	H	S	S	S	H	H	H	H	H
13	S	S	S	S	S	H	H	H	H	H
14	S	S	S	S	S	H	H	H	H	H
15	S	S	S	S	S	H	H	H	H	H
16	S	S	S	S	S	H	H	H	H[5]	H
17+	S	S	S	S	S	S	S	S	S	S
A2	H	H	D	D	D	H	H	H	H	H
A3	H	H	D	D	D	H	H	H	H	H
A4	H	H	D	D	D	H	H	H	H	H
A5	H	H	D	D	D	H	H	H	H	H
A6	D	D	D	D	D	H	H	H	H	H
A7	S	D	D	D	D	S	S	H	H	S
A8	S	S	S	S	S	S	S	S	S	S
A9	S	S	S	S	S	S	S	S	S	S
2 2	P	P	P	P	P	P	H	H	H	H
3 3	P	P	P	P	P	P	H	H	H	H
4 4	H	H	H	P	D	H	H	H	H	H
5 5	D	D	D	D	D	D	D	D	H	H
6 6	P	P	P	P	P	P	H	H	H	H
7 7	P	P	P	P	P	P	P	H	S	H
8 8	P	P	P	P	P	P	P	P	P	P
9 9	P	P	P	P	P	S	P	P	S	S
10 10	S	S	S	S	S	S	S	S	S	S
A A	P	P	P	P	P	P	P	P	P	P
5-7	H	H	H	H	H	H	H	H	H	H
8	H	H	H	D[6]	D[7]	H	H	H	H	H
9	D	D	D	D	D	H	H	H	H	H
10	D	D	D	D	D	D	D	D	H	H
11	D	D	D	D	D	D	D	D	D	D

H = HIT, S = STAND, D = DOUBLE DOWN, P = SPLIT
IF DOUBLING DOWN IS INDICATED AND PLAYER HAS MORE THAN TWO CARDS, THEN HIT
NEVER TAKE INSURANCE

[5] Stand with three or more cards.

[6] Do not double with 6-2

[7] Do not double with 6-2

Appendix 2 : Evolved basic strategy

	Dealer's Upcard									
Your hand	2	3	4	5	6	7	8	9	10	A
12	H	H	S	S	S	H	H	H	H	H
13	S	S	S	S	S	H	H	H	H	H
14	S	S	S	S	S	H	H	H	H	H
15	S	S	S	S	S	H	H	H	H	H
16	S	S	S	S	S	H	H	H	H	H
17+	S	S	S	S	S	S	S	S	S	S
A2	H	H	D	D	D	H	H	H	H	H
A3	H	H	D	D	D	H	H	H	H	H
A4	H	H	D	D	D	H	H	H	H	H
A5	H	H	D	D	D	H	H	H	H	H
A6	D	D	D	D	D	H	H	H	H	H
A7	S	D	D	D	D	S	S	H	H	S
A8	S	S	S	D	D	S	S	S	S	S
A9	S	S	S	S	S	S	S	S	S	S
2 2	P	P	P	P	P	P	H	H	H	H
3 3	H	H	P	P	P	P	H	H	H	H
4 4	H	H	H	D	D	H	H	H	H	H
5 5	D	D	D	D	D	D	D	D	H	H
6 6	P	P	P	P	P	H	H	H	H	H
7 7	P	P	P	P	P	P	H	H	S	H
8 8	P	P	P	P	P	P	P	P	P	P
9 9	P	P	P	P	P	S	P	P	S	S
10 10	S	S	S	S	S	S	S	S	S	S
A A	P	P	P	P	P	P	P	P	P	P
5-7	H	H	H	H	H	H	H	H	H	H
8	H	H	H	D	D	H	H	H	H	H
9	D	D	D	D	D	H	H	H	H	H
10	D	D	D	D	D	D	D	D	H	H
11	D	D	D	D	D	D	D	D	D	D

H = Hit, S = Stand, D = Double down, P = Split
If doubling down is indicated and player has more than two cards, then hit
Never take insurance
Stop playing when receiving a pair of 9s or when two or more aces are dealt in a single round

Appendix 3: Evolved plus-minus count strategy

Use the evolved basic strategy with the following exceptions: 12 vs. 2 (+3:S/H), 12 vs. 3 (+2:S/H), 12 vs. 4 (+2:S/H), 12 vs. 5 (0:S/H), 12 vs. 6 (–1:S/H), 13 vs. 2 (0:S/H), 13 vs 3 (0:S/H), 13 vs 4 (–2:S/H), 14 vs. 2 (–2:S/H), 15 vs. 10 (+4:S/H), 16 vs. 9 (+3:S/H), 16 vs. 10 (+1:S/H), A2-5 vs. 4 (–1:D/h), A7 vs. A (0:S/H), A8 vs. 5-6 (0:D/S), 44 vs. 5-6 (2: D/H), 77 vs. 10 (0: S/H), 99 vs. 2 (–2: P/S), 8 vs. 5-6 (2: D/H), 9 vs. 2 (1: D/H), 9 vs. 3 (0: D/H), 9 vs. 4 (–1: D/H), 10 vs. 9 (+1: D/H), 10 vs. 10-A (+3: D/H), 11 vs. 10 (0: D/H), 11 vs. A (–1:D/H). H = Hit, S = Stand, D = Double down, P = Split If the true count is greater than or equal to the number indicated, take the action listed first, otherwise take the second action. If doubling down is indicated and player has more than two cards, then hit. Take insurance when the true count is greater than or equal to +2. Stop playing when receiving a pair of 9s or when two or more aces are dealt in a single round Count 2-6 (+1), 7-9 (0), 10s and Aces (–1).